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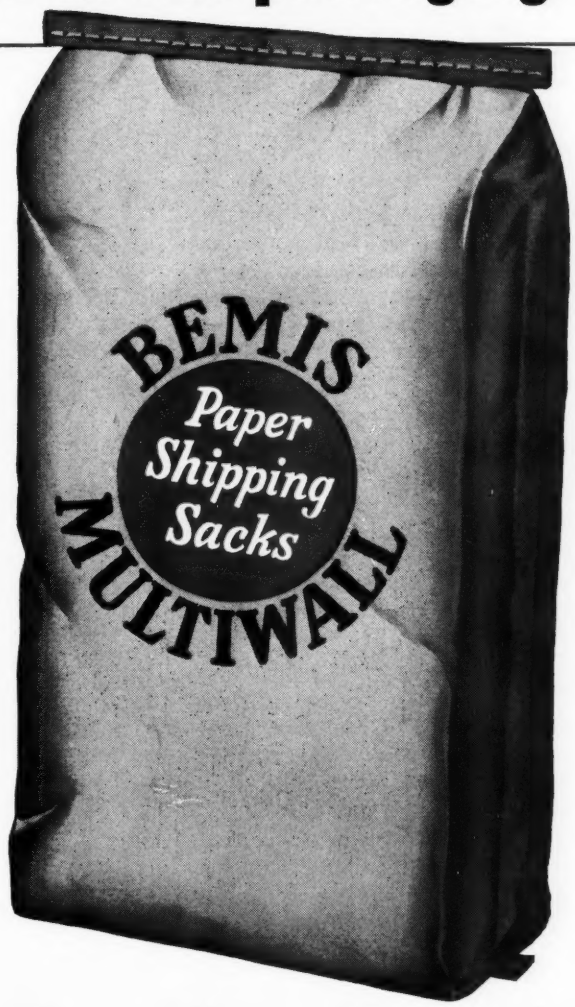

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The American FERTILIZER

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Pasture Fertilization as It Affects Grazing in the Southeastern United States

By O. E. Sell

Pasture Specialist, Georgia Agricultural Experiment Station

KNOWLEDGE and use of fertilizers and lime for pastures have made possible great improvements in grazing in the South in the last ten to fifteen years. Pasture fertilization and lime were first confined largely to permanent pastures. Most recent improvements in the pasture program have been in winter pastures, where fertilization has played as important a part as with permanent pastures.

Seeding Failures

There were widespread attempts to establish pastures and a livestock industry in the Southeast right after World War I. This was at a time when the boll weevil was first seriously threatening cotton production, and farmers had money with which to purchase cattle and seeds for pasture establishment. A survey made of the results of such seedings in Georgia revealed almost universal failures, except for carpet grass. We know now that carpet grass is able to grow on soils low in fertility and it is low in nutritive value, compared to our more desirable pasture plants. There is no record of adequate or even any fertilizer or liming practises being carried out in conjunction with the pasture seedings. In the light of present knowledge, no other outcome than failure could have been expected from pasture seedings without fertilization.

Seeding Success with Fertilization

As more and more information became available on the needs of pastures for fertilizers and lime, an increasing number of farmers improved pastures and established additional acreages. Most of this has occurred in the last fifteen years. Some indication of the extent to which southern farmers went in this program is shown by United States Census figures. Total pasture acreage in the South went from 173,612,000 to 197,818,000 acres, an increase of 24 million acres, in the ten-year period from 1934 to 1944. During the same period cattle number increased by four million, from 21,818,000 to 25,902,000. There undoubtedly has has been a decrease in cattle numbers in the last five years due to high prices, but an upward trend has been established and will continue. These figures do not, however, give a complete picture of the changes that have taken place. Improved pastures have a considerably greater carrying capacity, provide a longer grazing season, and furnish more nutritious forage than unimproved pastures; therefore they result in greater livestock production. Also, cattle in some sections of the Southeast are better in type, are better finished, and heavier in weight than they were previous to the general trend to more and better pastures.

Most of the land in the Southeast that was in pastures or that was changed from some other use to pastures was generally poor and low in fertility. The reduction in the South of idle cropland to the extent of 4.6 million acres, corn to the extent of 6.4 million acres, cotton to the extent of 7.9 million acres, and of 14 million acres of woodland account for most of the 24 million acres increase in pasture land. Fertilizer experiments have shown that most such lands need a heavy application of fertilizers and lime to successfully establish good pastures. Many soil tests have corroborated the fact that most such soils have little or no available phosphorus and lime, and on certain soils, also potash.

Fertilizer Grazing Experiments

First attempts at pasture improvement on the heavy Piedmont soils were rather simple and inclined toward keeping fertilizer costs

low because high returns from grazing were not expected. Idle land infested with bermuda was scarified bu disking, 500 pounds of 16 per cent superphosphate and one and one-fourth ton of lime were top-dressed per acre, and white and subterranean clovers seeded in the fall. Applications of phosphate were repeated every three years, lime less often, and potash was applied only once. The clovers furnish grazing in the spring while the bermuda predominates in summer. Grazing has usually started in March and continued until November 1, although drought in a number of years necessitated the removal of the animals from this pasture in late summer. An average of about one animal unit has been carried per acre. Over an eleven year period this improved pasture produced an average of 254 pounds beef gains per acre at an annual cost of $3.79 per acre for fertilizers, lime and seeds. An adjacent unimproved pasture during the same period produced only 124 pound beef gains per acre.

Although the beef production on this improved pasture is reasonably high, there is evidence that insufficient plant food was supplied. The winter clover growth was poor or even absent some years, and it was necessary then to apply commercial nitrogen to obtain summer grass production. In some years when clover growth was excellent, forage yield data indicate that summer grass production was stimulated by the clover to the same extent that 64 pounds of nitrogen from fertilizers did. Although weather conditions have some effect on changes in clover and thus pasture production, lack of sufficient plant nutrients very likely would have given greater production. Further evidence on this is shown by another improved pasture that received twice as much lime and phosphate at the beginning as the above pasture and produced an average of 380 pounds of beef per acre during the eleven-year period. During the last six years this pasture averaged 501 pounds beef gains per acre. Thus rather heavy fertilization of pastures is warranted and, to a certain extent, necessary.

This increased livestock production on improved pastures has been due in part to the increased amount of forage produced, and perhaps to an even greater degree, to the higher nutritional value of the forage. Fertilization of any forage plant usually increases its nutritional value, but the greatest improvement is the result of a change in plant species. The most common plant found in unfertilized pastures in the South is broomsedge, although other low quality grasses, such as poverty grass and wire grass, predominate under some soil conditions. These plants can grow in soils low in fertility but they cannot furnish livestock with sufficient quantities of nutrients needed. Broomsedge grass, for example, was found to contain only 6.25 per cent crude protein, 0.25 per cent calcium, and 0.47 per cent phosphoric acid, even when it was in a young tender growth stage. White clover, which could only be grown after the land was properly fertilized and limed, was found to contain 25.2 per cent crude protein, 1.18 per cent calcium, and 0.64 per cent phosphoric acid.

New Pasture Production Possibilities

New information being obtained indicates that changes may be desirable or necessary from the rather simple inexpensive fertilization practises followed in the early grazing experiment cited. For one thing, the amount of nitrogen supplied by winter clover to the summer grass will seldom allow maximum production of the Summer grass. As much as 12,000 pounds (dry weight) bermuda grass-Ladino clover forage has been produced per acre with heavy nitrogen and mineral fertilization: 128 pounds of nitrogen, 64 pounds of P_2O_5 and 67 pounds K_2O per acre on an annual basis. Coastal bermuda in the Coastal Plains area has produced up to six and ten tons dry forage per acre when 300 to 400 pounds of nitrogen were applied per acre. While some of this heavy forage production can be harvested as hay for winter feed, there is still a need to determine whether and how such heavy pasture fertilization and forage production can be utilized economically in a livestock program. One fact should not be overlooked, that the rate of application of the other plant food nutrients must be increased when the rate of nitrogen fertilization is increased.

Supplementary irrigation of both summer pastures and of winter pastures pays good dividends, even though much of the Southeast receives the considerable sum of 50 inches of rainfall annually. Permanent summer pastures, which contain white or Ladino clover, are benefited by irrigation not only through increased dry matter production but also through greatly improved quality of the forage. Summer growing bermuda and Dallis grass usually predominate in hot weather while the stand of white and Ladino clover deteriorates or dies out completely. The use of supplementary irrigation during drought periods enables these clovers to maintain stands sufficient to constitute 50 to 60 per cent of the available forage present. Such benefits were clearly illustrated in a clipping experiment where a 58 per cent increase in crude protein production was obtained with supplementary irrigation. The better quality forage produced by irrigation is of particular importance to dairymen, and numerous dairy farmers are equipping themselves for pasture irrigation. As with high nitrogen fertilization, irrigation will necessitate heavier rates of mineral fertilization. As much as 178 pounds of 50 per cent muriate of potash has been removed per acre in a year, for example, where irrigation was practised and heavy forage yields were obtained.

One great difficulty with winter grazing is the generally insufficient soil moisture which retards germination of fall sown pastures and retards growth of established stands. In addition, diseases such as *Helminthosporium* are much more severe, reducing stands and forage growth, when any factor such as lack of sufficient soil moisture or nitrogen retards germination or growth of the plants. Dairymen and others who practise fall irrigation and adequate fertilization can

(*Continued on page 29*)

Fertilizer Experiments and Crop Yields in Japan and Some Comparisons With Those in the United States

By C. L. W. SWANSON

Chief Soil Scientist, Connecticut Agricultural Experiment Station, New Haven, Conn.

(*Continued from the issue of February 4, 1950*)

Weakness of Japanese Experimental Techniques

Investigation of experimental techniques used by Japanese agriculturists in fertilizer experiments shows several defects. In general, the experimental techniques are not as refined and modern as those used in the United States. The most serious faults are the limited number of replicates and the small size of the experimental plots. In addition, experimental plots are often established without any statistical design. Consequently, except in the case of some long-time experiments, a statistical evaluation of results is impractical.

More detailed information on basic soil and climate characteristics for the experiments discussed would have been highly desirable. Such data would have been helpful in accounting for differences in crop response to fertilization in different localities. From the information available, it appears that generally the greatest response of crops to fertilizers is obtained on the so-called "diluvial"[8] soils. This is especially true with phosphatic fertilizers on diluvium covered with weathered volcanic ash, as in the Kanto Plain area (*1*). Considerable crop response to potash fertilization has been obtained on soils of granitic origin.

From the data, it appears that the optimum amounts of nitrogen to apply to lowland rice range from 60 to 120 kg. of N per hectare (53.5 to 107.1 lb./acre). The Ministry of Agriculture and Forestry (*16*) recommends applications ranging from 64 to 152 kg. (57 to 135.6 lb./acre). Optimum applications of phosphorus seem to be between 20 and 60 kg. of P_2O_5 per hectare (17.8 to 53.5 lb./acre). The Ministry's recommendations are from 41 to 94 kg. per hectare (36.6 to 83.9 lb./acre). The desirable quantities of K_2O for lowland rice appear to be between 40 and 80 kg. per hectare (35.7 to 71.4 lb./acre) compared with the Ministry's recommendations of 56 to 110 kg. (49.9 to 98.1 lb./acre).

Less data are available on the fertilizer response of wheat than for lowland rice. Reliable estimates on the fertilizer requirements of wheat are, therefore, more difficult to make. Moreover, most of the data were obtained from experiments conducted on the more fertile alluvial soils. Consequently, estimates of optimum fertilizer treatment, based on these data, are probably much lower than the actual fertilizer requirements of wheat grown on the less fertile "diluvial" soils. From the results of field experiments conducted at four localities, optimum nitrogen applications appear to be between 80 and 120 kg. of N per hectare (71.4 to 107.0 lb./acre). In comparison, the Ministry's (*16*) recommendations range from 103 to 173 kg. per hectare (91.9 to 154.3 lb./acre). In the case of phosphoric acid, optimum applications seem to range from 40 to 80 kg. of P_2O_5 per hectare (35.7 to 71.4 lb./acre). The Ministry recommends about 43 to 103 kg. of phosphoric acid per hectare (38.3 to 91.9 lb./acre). For potash, the data indicate that optimum potash applications are between 20 and 60 kg. of K_2O per hectare (17.8 to 53.5 lb./acre). Much higher recommendations, 71 to 95 kg. of K_2O per hectare (63.3 to 84.7 lb./acre), are made by the Ministry.

Estimates of optimum rates of fertilizer applications for naked barley under actual farming conditions in Japan are subject to the same restrictions as estimates for wheat. The data indicate that per hectare optimum amounts are 100 to 140 kg. of N (89.2 to 124.9 lb./acre), 40 to 100 kg. of P_2O_5 (35.7 to 89.2 lb./acre), and 40 to 80 kg. of K_2O (35.7 to 71.3 lb./acre). The recommendations of the Ministry of Agriculture and Forestry (*16*) are the same for naked barley as those for wheat. Leonard (*7*) states that the recommended amounts of fertilizers for barley were generally higher than the amounts used.

Data from field experiments indicate that optimum amounts of fertilizer nutrients per hectare for mulberry are about 150 to 225 kg. of N (133.8 to 200.7 lb./acre), 40 to 115 kg. of P_2O_5 (35.7 to 102.6 lb./acre), and 70 to 115 kg. of K_2O (62.4 to 102.6 lb./acre). In comparison to these figures, the Ministry's (*16*) recommendations are 188 to 244 kg. of N (167.7 to 217.7 lb./acre), 75 to 113 kg. of P_2O_5 (66.9 to 100.8 lb./acre), and 113 to 188 kg. of K_2O per hectare (100.8 to 167.7 lb./acre).

Because of insufficient data, optimum amounts of fertilizer nutrients to apply to other crops are not included in this paper. Recommendations of the Ministry of Agriculture and Forestry (*16*) for these and other crops are included in a special report on fertilizer practices in Japan.

[8] The term "diluvial" has been given to the older, coarse-textured and higher terraces by Japanese geologists and geographers to distinguish them from the more recently deposited alluvium. It is not known to which great soil group or groups these "diluvial" soils would belong but they probably would not be classified as Ando soils (13).

It is not known why the fertilizer recommendations of the Ministry of Agriculture and Forestry for the crops discussed are higher than research results indicate they should be. Possibly because the field trials are limited in number and of inadequate design and extent, the recommendations based on research data may be low.

Yields of Major Crops Increased Tremendously in Sixty-four Years

In spite of the fact that Japan's experimental techniques may be somewhat antiquated in comparison with those used in the United States, yields of some of her major crops have increased tremendously. Using as a basis of comparison the five-year periods ending in 1882 and 1942, production per hectare of rice increased 70 per cent; wheat, 140 per cent; common barley, 119 per cent; naked barley, 62 per cent; and tea, 180 per cent (*10,11*). Since 1942 yields have declined somewhat, owing largely to inadequate supplies of fertilizers.

All of this increase cannot be attributed directly to research on crops. It can be safely assumed that laboratory and field experiments on the use of fertilizers, more efficient use of larger quantities of fertilizers, careful control of widespread plant diseases and insect pests, and improvement and use of better plant varieties are factors primarily responsible for these relatively large yield increases. The fact that little regard is given to the amount of labor expended in growing crops means that each plant practically receives individual attention. Production under these circumstances can be expected to rise.

Comparison of Fertilizer Use and Crop Yields in the United States with Those in Japan

Examination of world fertilizer consumption statistics by Clark and Sherman (*4*) show some very interesting comparisons. When a comparison is made of the average amounts of commercial fertilizers consumed by the world's major agricultural countries during 1935–1937, in terms of pounds per acre of arable land, Japan was third in the total amount of nitrogen (37.4 lb.), fifth in phosphoric acid (34.4 lb.), and fifth in the total amount of potash (15.1 lb.) consumed. During the same years, the United States ranked 22nd in the use of nitrogen (2.1 lb.), 24th in phosphoric acid (4.4 lb.), and 19th in amount of potash (2.0 lb.) consumed. On the basis of world distribution of arable land, Japan ranked 19th and the United States second.

It is interesting to compare increases in yield for similar crops for a like period in the United States. Using the same basis of comparison, production per acre for wheat increased 23.4 per cent; barley 4.4 per cent; oats 16.8 per cent; and corn 19.3 per cent. If we use 1944–1948 as the last five-year period, increases in comparison with the 1878–1882 period for the same crops are as follows: wheat, 37.5 per cent; barley, 9.2 per cent; oats, 23.0 per cent; and corn, 36.6 per cent. The data are taken from Reports of the Commissioner of Agriculture (*9*) and a United States Department of Agriculture publication (*5*). Most of the increase in the United States occurred after 1941 when improvements in farm technology were adopted on a wider scale (*3*) which included use of improved plant varieties and larger use of fertilizers.

Making comparisons using yields alone for crops grown in the United States and Japan does not give a true picture of crop production in these two countries. American farmers are notable for their high yields of crops per man day, in which field they are preeminent. This is due, of course, primarily to extensive acreages and large operations, use of labor-saving machinery, and the relatively quick application of research findings of agricultural science. Hybrid corn is, in itself, an outstanding example. Since 1917, when Dr. D. F. Jones of this Station made the first "double cross," the acreage in hybrid corn has increased to more than 60 million acres annually. In some major corn-producing states nearly 100 per cent of the corn acreage is planted to hybrids. Once hybrid corn was made commercially available in the 'thirties, the use of hybrid corn spread almost like wildfire.

In Japan, the labor[9] required for producing crops is excessive. For example, an average of 24 man days and 3 horse days are required to produce the rice on one tan (0.24 acre) of paddy land. This amounts to approximately 96 man days per acre as compared to 1.5 man days per acre for producing the crop under the mechanized program in California. Labor requirements for other crops grown in Japan would follow a similar pattern.

It is apparent that maximum yields have not been obtained in the United States. If Japan[10] is used as a comparison, the United States has a long way to go. The fact that the United States has not reached its end point in crop production is particularly encouraging, especially in view of the fact that it is popular now in some circles, for various reasons, to maintain that the United States and the world as a whole will soon be short of food.

It may be optimistic, yet it should not be impossible, to obtain real significant increases in crop production in the United States. For example, corn yields of over 200 bushels per acre have been grown in a number of instances by farmers. The average yield for the United States for the 1944–1948 period was 34.7 bushels (*5*). The 1948 average yield was 42.7 bushels. Should it not be possible to increase average yields 50 per cent in the United States in the predictable future when for some crops the increase has been as much as 180

[9] Statistics from T. O. Engebretson, Office of Foreign Agricultural Relations, USDA, Washington, D. C.

[10] Some other countries produce higher yields of rice than does Japan. According to an article by L. T. Willahan entitled "Rice—A World Food Crop" in *Foreign Agriculture*, Vol. 12: 115 120, 1948, Spain, Italy and Australia outproduce Japan on average yields per acre of rough rice. Spain's highest reported average yield was 124.4 bushels per acre while the yield for Japan was 75.8 and for the United States 49.7 Japan, however, was the third largest world producer of rice before the war (1935 1939) in comparison to the relatively small total production of Spain.

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Wisconsin Fertilizer School

Agricultural College Conducts Two-Day Course for Fertilizer Dealers and Salesmen

LEADERS in the College of Agriculture at Madison, Wisconsin recognize fertilizer manufacturers, dealers and salesmen as valuable aids in spreading agricultural information.

The Wisconsin Agricultural College recently sponsored a two-day school to give representatives of the fertilizer industry basic information regarding soil fertility maintenance, and current fertilizer recommendations.

Soil Deficits

Professor Emil Truog, the eminently known soils scientist and Chairman of the Soils Department at the University of Wisconsin, compared economic crop production to simple sound banking and finance. He said, "If the soil is to do a satisfactory job of supplying crops with nutrients, then it must have adequate working capital in terms of plant nutrients. Some soils, even in their virgin condition, lack this capital with respect to certain nutrients. Many have had it depleted by exhaustive cropping. Less than one-fourth of the soils under plow in the North Central States have adequate capital in all respects."

Truog raised the question as to how the deficit in working capital (plant nutrients) be made up. He believes that the soil should be brought up to high fertility at once and then enough fertilizer added at frequent intervals for maintenance. Professor Truog said, "Although it may cost $25 to $50 per acre to supply the soil at once with adequate working capital in the form of lime and fertilizer, it was found in Wisconsin experiments that the increases in yield which resulted were produced at a cost for the unharvested crops of ten to fifteen cents per bushel for oats and corn, and two to three dollars per ton for clover and alfalfa hay. The costs involved are those of interest on the investment for lime and fertilizer, and of a charge or reserve sufficient to cover the depletion of fertility entailed by the increased yields and not made good by the increased returns of crop residues and manure."

Professor Truog continued, "Some agronomists have objected to adding at once sufficient fertilizer to make up known deficits in the soil because of the danger of large losses from leaching and fixation. Fortunately when what may be called normal soils of a favorable reaction are involved, this danger is not serious. 'The earth commits no breach of trust.' In fact, the trend in many sections is already in the direction of these heavy initial applications. As soon as fertilizer supplies permit, this trend will rise rapidly because it will cut cost of production, improve quality and nutritive value of our feeds and foods, and greatly facilitate soil conservation.

"Because a surplus of many agricultural crops exists today in this country, it might be argued that farmers should withhold the purchase and use of lime and fertilizer. What should be our position in this matter? I believe we should produce what is needed with the least possible cost to the farmer. That means high acre yields, and high acre yields means high fertility, such as is brought about by adequate applications of lime and fertilizers."

Fertilizer Composition

Professor E. J. Graul, Department of Soils of the University of Wisconsin, pointed up the importance of fertilizers in saying, "The composition of commercial fertilizers in relation to production of large and vigorous crops of high nutritive value for animal and human consumption merits as much consideration as the composition of the ingredients in the medicinal bottle. 'From dust thou art, to dust returneth,'—but in the meantime that 'dust' is very important. It no longer supports us without scientific modification, and that modification involves, among many things, a return to the soil of mineral plant nutrients taken out by ever increasing crop yields, erosion, leaching, fixation and what not. There is no question but that the maintenance of a balanced available nutrient content of soils is the basis for large yields and erosion control."

Professor Graul concluded his remarks with a few brief and pointed statements. First, "Farmers usually buy fertilizers on the basis of cost per ton, whereas they should buy on the basis of cost per unit of plant nutrients."

Second, "Farmers should buy the highest analysis fertilizers as is possible, because this reduces cost of bagging, shipping, and applying to soils, thus reducing the unit cost of plant food."

He dispelled the common idea that concentrated fertilizers are "hot stuff" by stating, "Concentrated fertilizers do not cause as much injury to germination as low grade materials because 'burn' is caused by the total of salts in the mixture and not alone by the plant nutrient elements. Less per acre of high grade mixtures will be used to give the desired amount of plant food; accordingly the total salt content will be less."

Alfalfa Production

Professor O. J. Attoe, also of the Soils Department, University of Wisconsin, had this to say about alfalfa production. "There is little doubt but that thousands of dollars are wasted in Wisconsin each year on alfalfa seed sown on land that is in urgent need of lime, phosphate, and especially potash. Even though good stands of seeding may sometimes be established under favorable weather conditions on such land, yields and protein content are usually low and the stand is often thinned by severe winter weather that follows. Many of our soils that now produce less than two tons of poor quality hay per acre will produce four tons of high quality

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NITROGEN THE MAGIC WORD, SAYS CHAPMAN

In a recent radio talk on crop production bottlenecks in Wisconsin, C. J. Chapman, Professor of Soils at the University of Wisconsin, gave farmers some very pointed advice when he said, "Yes, the lack of nitrogen was the bottleneck that held down yields on thousands and thousands of acres of corn in Wisconsin this past year; in fact, this has been true for many years. And while we did carry out a considerable number of plow-sole fertilizer demonstrations which resulted in some outstanding yield increases again in 1949, yet I'm more than ever convinced that nitrogen in the 800 to 1,000 lbs. of 8–8–8 is the element most responsible for these large increases. It's true that nitrogen applied as a side-dressing to one of our corn plots this year resulted in most spectacular increases. On the farm of Joseph Sharratt at Mazomanie a side-dressing of nitrogen fertilizer applied July 16 increased the yield of corn silage from 15,500 to 25,000 lbs. per acre. And this increase of 4½ tons of silage at a value of $8 per ton amounted to $36. The cost of 45 lbs. of nitrogen (N) was $5.50."

Professor Chapman continued, "Yes, I still stick to my guns on the importance of minerals to back up nitrogen in these plow-sole or plow-under fertilizer treatments on low fertility fields. And it's true most of these back 40 fields do need the phosphate and potash contained in an 8–8–8 fertilizer."

Professor Chapman in summing up his remarks stated that he could, "see a great opportunity for increasing yields on Wisconsin farms. The magic word is nitrogen. Yes, nitrogen for more grass, nitrogen for more grain, nitrogen for more corn. But in the same breath I also say—let's build our long time crop production program on a solid foundation with liberal applications of lime, phosphate and potash in a program of good crop management, with longer rotations including more legumes in those rotations."

JUNE N.F.A. CONVENTION TO FEATURE EXHIBIT DISPLAY

The 1950 N.F.A. Convention June 12–15 at the Greenbrier, White Sulphur Springs, West Virginia, will be an important part of the centennial of our industry and according to reports from N.F.A. headquarters plans are now made for an outstanding four-day meeting.

One of the features in which any member or contributor is cordially invited to participate is the display of exhibits illustrating the "Century of Progress" theme.

The space provided for such exhibits is limited and if you wish to exhibit please let N.F.A. know not later than March 1 regarding the nature of your exhibit and the amount of floor space that would be desired. There will be no charge for floor space. All other expenses connected with each exhibit will be borne, of course, by the exhibitor.

All exhibit arrangements, including assignment of space, will be handled by a committee of the Board of Directors, and information received at the Washington office in response to this invitation will be forwarded to the committee.

V-C BUILDING PESTICIDE PLANT IN MONTGOMERY

Construction of a new insecticide manufacturing plant for the Tobacco By-Products and Chemical Corporation of Richmond, Virginia, is underway in Montgomery, Alabama, and officials of the company expect production of general pesticides to start around April 1.

Montgomery was selected for the plant site because of its strategic location, since the plant will specialize in insecticides for cotton, peanut, vegetable, and fruit crops of the South.

The plant is being erected on property of the parent company, Virginia-Carolina Chemical Corporation, and will be located adjacent to the V-C Fertilizer Plant in Montgomery.

Sales to distributors and dealers of cotton poisons and other insecticides will be handled jointly by the Tobacco By-Products and Chemical Corporation and V-C Sales Offices throughout the South.

Producers of insecticides since 1885, the by-products firm has long been the world's leading producer of nicotine sulphate. Its other plants are located in Richmond, Virginia, and Louisville, Kentucky.

The Montgomery plant is the first to be erected for the manufacture of a general line of pesticides "in an effort to better serve the crop protection needs of southern agriculture."

TAYLOR PROMOTED TO CONSTRUCTION ENGINEER BY I. M. & C.

An announcement by Louis Ware, president of International Minerals & Chemical Corporation at Carlsbad, New Mexico, reveals that James L. Taylor, for the past two years chief engineer for the potash mine and refinery has been appointed construction engineer for the entire corporation. Mr. Taylor, whose appointment became effective February 10th, will be located in the central engineering division offices at the corporation headquarters in Chicago, and will serve directly under Thomas M. Ware, chief engineer.

Mr. Taylor has been with the organization for the past 10 years, joining the Union Potash & Chemical Company which was ultimately merged with International Minerals & Chemical Corporation. He was responsible for the potash refinery installation at Carlsbad, the phosphate flotation plant at Mulberry, Florida, and the layout and design of many other company facilities throughout the United States.

He studied at the New Mexico School of Mines, Soccorro, New Mexico, and graduated from Tri-State College at Angola, Indiana with a degree in civil engineering. He is a member of American Institute of Mining and Metallurgical Engineers, the Colorado Society of Engineers, and New Mexico Miners and Prospectors Association.

KANSAS CITY BRANCH OPENED BY LINK-BELT

The opening of a factory branch store and warehouse in Kansas City, Mo., is announced by Link-Belt Company.

Arthur J. Olson, district manager, points out that the company has long felt the need for a factory branch store in Kansas City, with liberal stocks, in order to supply the territory's ever-expanding requirements more quickly—either direct or through distributors.

Ample stocks of conveying and power transmission machinery parts, chains, sprockets, bearings, speed reducers, elevator buckets, etc., will be carried at the new address so that customers in the Kansas City area and surrounding territory can be served promptly from local stocks.

BETTER TEST DRILLING METHODS REPORTED

Using more efficient drilling practices and tools in improved methods of diamond-drilling in phosphate-bearing beds of Idaho and Wyoming has resulted in greater core (sample) recovery.

Bureau U. S. Mines Director Boyd reports that the Bureau recovered an average of 82 per cent of the core from the 11 holes drilled in the phosphate beds, the report points out. From this improved core recovery—from 20 to 50 per cent greater than standard drilling in the past—beds in the area most suitable for mining and processing can now be determined more accurately.

A truck-mounted, gasoline-powered drill on a 36-foot steel mast—commonly known as a seismograph drill—was used, Boyd's report states. Modifications were made in the standard drill head by the addition of pressure gages attached to hydraulic-feed cylinders and by relocation of the water pressure gage.

A copy of the publication may be obtained free from the Bureau of Mines, Publications Section, 4800 Forbes Street, Pittsburgh 13, Pa It should be identified by number and name. (Report 4597, "Experimental Drilling in Idaho.")

1949 TAG SALES TOP 1948 BY 400,000 TONS

The National Fertilizer Association reports that fertilizer tax tag sales plus shipment tonnage figures from certain states totaled 9,626,000 equivalent short tons during the calendar year 1949. This figure is based on reports from 13 Southern and Midwestern states having programs involving fertilizer taxation. The 1949 tonnage represents a gain of some 291,000 over the comparable figure for 1948. Fertilizer consumption for the nation as a whole, it will be recalled, reached an all-time high in 1948.

While 1948 equivalent tonnages exceeded those of 1949 in 8 of the 12 months, exceptionally large amounts reported for February, March, April and May, 1949, were more than sufficient to offset declines reported during the remaining months.

Of the total recorded for last year, 7,900,000 tons were accounted for by 10 Southern states and 1,726,000 tons were reported by the three Midwestern states. The South's figure represents an increase of roughly six per cent over 1948 while the Midwest's represents a decline of about nine per cent.

During the first 6 months of the current fiscal year, a total of 2,611,000 equivalent short tons have been reported, as compared with 3,143,000 during the same period a year earlier. The decline from 1948 has been about the same, proportionately in the South as in the Midwest.

During the latest reporting month of December, tax tag sales and shipment tonnages totaled 554,000 equivalent short tons, 383,000 tons of which were reported by the Southern group and the remaining 171,000 tons by the Midwest. Corresponding December 1948 figures were as follows: South, 525,000 tons; Midwest, 254,000 tons.

The decline in December sales reflects the unwillingness of farmers to take their fertilizer purchases during the late fall and early winter months. The shortage of potash caused by the recent strike also slowed up production, and consequently, shipments. It is expected that the figures for February, March and April will bring the totals more nearly into balance.

FERTILIZER TAX TAG SALES[1] AND SHIPMENT TONNAGES[2]

(In Equivalent Short Tons)

COMPILED BY THE NATIONAL FERTILIZER ASSOCIATION

State	December		Calendar Year Cumulative January-December		Fiscal Year Cumulative July-December	
	1949	1948	1949	1948	1949	1948
Virginia (t)	26,773	30,959	682,415	633,265	188,428	190,906
N. Carolina[3]	33,283[c]	147,446	1,451,638	1,550,322	190,752	463,938
S. Carolina (t)	52,404	56,488	962,716	883,608	200,144	235,940
Georgia (t)	44,927	47,272	1,233,635	1,179,879	217,213	259,963
Florida (t)	126,073	85,619	984,092	748,023	468,629	348,174
Alabama (t)	29,581	59,960	1,042,369	961,578	165,517	186,364
Tennessee (t)	13,691	26,248	461,775	447,511	101,043	141,572
Arkansas (t)	18,050	22,311	334,595	252,919	67,418	88,408
Louisiana (r)	10,590	16,324	241,589	198,378	56,444	69,421
Texas (r)	28,036	31,949	505,497	467,069	215,649	209,306
Total South	383,408	524,576	7,900,321	7,322,552	1,871,237	2,193,992
Indiana (t)	98,264	169,427	770,739	915,776	405,419	507,075
Kentucky (t)	53,710	54,618	500,462	554,061	166,047	211,329
Missouri (t)	18,664	30,111	454,391	421,407	167,984	185,756
Total Midwest	170,638	254,156	1,725,592	1,891,244	739,450	904,160
Grand Total	554,046	778,732	9,625,913	9,213,796	2,610,687	3,098,152

[1] The letter (t) denotes States whose data are based on sales of fertilizer tax tags. The figures are the number of short tons of fertilizer represented by the tags sold to fertilizer producers who are required by law to attach one to each bag of fertilizer they sell in these States. The tonnage so represented may be somewhat larger or smaller than actual amounts of fertilizer sold because of the lag between the purchase of tags and the delivery of fertilizer on which those tags are used.

[2] Current tonnage figures for states whose names are followed by (r) are the shipments of fertilizer or use in these states as reported by manufacturers to the appropriate state agencies.

[3] North Carolina law permits each manufacturer either to use tax tags or to submit monthly reports on the amounts of fertilizer shipped in the state. Current figures are the total (unduplicated) number of short tons of fertilizer represented by both tax tag sales and manufacturers' reports.

[c] Estimated.

FERTILIZER MATERIALS MARKET

NEW YORK

Coal Strike Affects Production of Sulphate of Ammonia but Supplies Adequate to Meet Current Demands. Potash Production Gradually Approaching Pre-strike Levels. Superphosphate Shipments Still Waiting Potash Deliveries. Feed Materials in Lower Demand

NEW YORK, February 15, 1950

Sulphate of Ammonia

If the coal strike continues, it is thought it will have some effect on the production of this material as far as the by-product material is concerned. Demand was fair but supplies are still adequate in the hands of the producers to supply any anticipated demand this season.

Nitrate of Soda

Shipments were reported moving a little better, particularly in the South, with no price changes reported.

Nitrogenous Tankage

This material is scarce and hard to buy and leading producers are sold up until June. Some foreign material recently arrived.

Castor Pomace

With last sales at $30.50 per ton, f.o.b. production points, and no material offered, this market continued strong and the demand was greater than the supply.

Organics

Tankage and blood were moving rather slowly because most feed buyers were out of the market. Chicago blood and tankage were quoted at about $6.75 per unit of ammonia ($8.20 per unit N). Soybean meal in bulk was reported as selling as low as $47.00 per ton, f.o.b. Decatur, Ill., and linseed meal in bulk, f.o.b. Eastern points, as low as $64.00 per ton, with cottonseed meal at about $55.00 per ton, f.o.b. southeastern points. The feed business in some sections has been rather poor for some time and a good many of the buyers have decided to postpone buying for the time being. There was some demand from the fertilizer trade.

Fishmeal

This material continues to arrive from abroad in increasing quantities, which is having an effect on the domestic market. With the feed trade slow and buying limited, very few sales were reported. Menhaden fish meal was held at around $165.00 per ton, f.o.b. shipping points.

Bone Meal

Fertilizer manufacturers are taking on supplies as needed and demand has increased. The demand for feeding bone meal is rather slow.

Hoof Meal

This material was a little easier in price in sympathy with tankage and blood and the market was nominally quoted at $7.00 ($8.51 per unit N), f.o.b. Chicago.

Superphosphate

Leading producers state shipments are still behind last year, with most manufacturers reluctant to take in additional material until the arrival of much needed potash. It is expected, as potash supplies arrive at buyer's plants, the demand for superphosphate will increase. Some recent export business has been reported booked.

Potash

With the settlement of the strike, production has been resumed but shipments are being made rather slowly and it is still thought a shortage will exist during the current fertilizer season. It has been reported that heavy sales of foreign potash have been made but most of the deliveries will be rather late.

Cocoa Shells

This material is moving rather slowly at the present time and supplies seem to be accumulating at certain points. This is indirectly caused by the potash situation, buyers not having enough potash to use for mixtures.

CHICAGO

Organics Market Still Slow in Spite of Price Reductions. Little Interest in Future Sales

CHICAGO, February 13, 1950

The market on animal ammoniates and feeding materials continues very slow and even reductions in prices have failed to stimulate any substantial interest. There is report that some dry rendered material sold as low as $1.40 to outside points but, as a whole, producers are pretty well sold up for February. There seems to be practically no interest in wet rendered tankage or dried blood so that it is quite difficult to determine just where this market stands.

Meat scraps are quoted as low as $88.00 per ton although some are still talking $100.00. Digester tankage is weak at $100.00 with $95.00 possible. Dry rendered tankage is slow at $1.45 to $1.50 per unit of protein. Bids at the lower figure would undoubtedly be accepted. Wet rendered tankage is strictly nominal at $6.75 to $7.25 per unit of ammonia ($8.20 to $8.82 per unit N), with very limited trading. Dried blood seems to be top at $6.25 ($7.59 per unit N). Steamed bone meal, 65 per cent, is nominally $70.00 per ton and raw bone meal $75.00 per ton.

PHILADELPHIA

Settlement of Potash Strike Helps Movement of All Materials. Supplies of Nitrogen and Superphosphated Considered Adequate

PHILADELPHIA, February 13, 1950

Although the potash strike has been settled, the general raw materials market is not too active. Organics have fallen off considerably, due to lack of feeding demand. Supplies of all materials seem now fully equal to any current demand.

Sulphate of Ammonia—It is expected that with settlement of the potash strike the movement of sulphate of ammonia will be accelerated, and while production in some spots may be restricted by the coal strike, the overall supply is quite in excess of requirements. While no domestic price changes are recorded, it is noted that sales of a large tonnage to the Army for use in Korea, were at prices much lower than those prevailing here. One 40,000 ton bid is reported at $35.22 per ton.

Nitrate of Soda—Demand has picked up somewhat with the advancing season, and some buyers are said to have increased their nitrate orders, hoping in some manner to offset the potash scarcity. Supplies are plentiful and no price changes are indicated.

Blood, Tankage, Bone—Demand for these organics has slackened very materially and while prices are indicated nominally at $7.25 to $7.75 per unit of ammonia ($8.82 to $9.42 per unit N), sales have been put through on a much lower basis where buyers have made counter-bids. Bone remains nominally at $65.00 per ton, with demand very slow. Hoof meal is quiet and nominal at $7.00 per unit of ammonia ($8.51 per unit N).

Castor Pomace—Price was advanced to $30.50 per ton at producers' plants, but very little was offered. None is in the open market now.

Fish Scrap—Market is very quiet with limited offerings of menhaden meal at $150.00 to $160.00 per ton, and scrap $10.00 per ton lower.

Phosphate Rock—Better conditions in the superphosphate trade have helped increase the movement from the mines. The supply is sufficient to meet all domestic requirements.

Superphosphate—Shipments are beginning to show better movement, due to settlement of the potash strike. Stocks are ample and no price changes are noted.

Potash—The strike has been settled and domestic supplies are beginning to trickle through. A considerable tonnage of Russian potash is said to have been purchased for shipment to United States in February and March and the first arrival is expected here the latter part of this month. Further offerings for April shipment are not getting much interest, however.

CHARLESTON

Organics Prices Weaken. Potash Shipments Resumed and General Situation Improved

CHARLESTON, February 13, 1950

Organics are in tight supply. Superphosphate is moving in better volume and stocks are adequate. Potash, in spite of settlement of the strike, is still tight and demand for other sources such as ground cotton bur ash is strong.

Organics—Fertilizer grade organics continue scarce, but blood and tankage recently have weakened in price sufficiently to sell to fertilizer manufacturers, although prices are higher than usual fertilizer grade organics. Domestic nitrogenous tankage is nominal, $3.75 to $4.00 per unit of ammonia ($4.56 to $4.86 per unit N), in bulk, f.o.b. production point, but supplies for the next three months are sold up. Imported organics are quoted for arrival too late to interest fertilizer manufacturers for this season.

Castor Pomace—The producers continue sold up and the price is nominally $30.50 per ton in bags, f.o.b. Northeastern production points.

Dried Ground Blood—Sales have been made recently at $7.00 per unit of ammonia ($8.51 per unit N), in bulk delivered Southeastern destinations.

Potash—Although the workers have reported back to the mines in the Carlsbad area, fertilizer manufacturers in the Southeast continue extremely short of supplies and it is uncertain whether supplies will be available in sufficient quantity to produce all the desired grades of mixtures in time for application to crops.

Ground Cotton Bur Ash—This source of carbonate of potash continues to sell heavily. It is quoted at 65 cents per unit of K_2O, in bulk f.o.b. Texas production point for material analyzing 30 per cent to 40 per cent K_2O and 3 per cent to 4 per cent chlorine.

Phosphate Rock—The superphosphate situation has improved, allowing better volume in shipments of phosphate rock. Supplies continue adequate and prices firm.

Superphosphate—Settlement of the potash strike is expected to increase the movement of superphosphate. Prices continue steady and supplies adequate.

Sulphate of Ammonia—Production of coke oven material will decrease as the coal strike continues, but supplies of synthetic material are adequate to meet the current demand. Prices range from $45.00 to $48.00 per ton, f.o.b. production points in bulk.

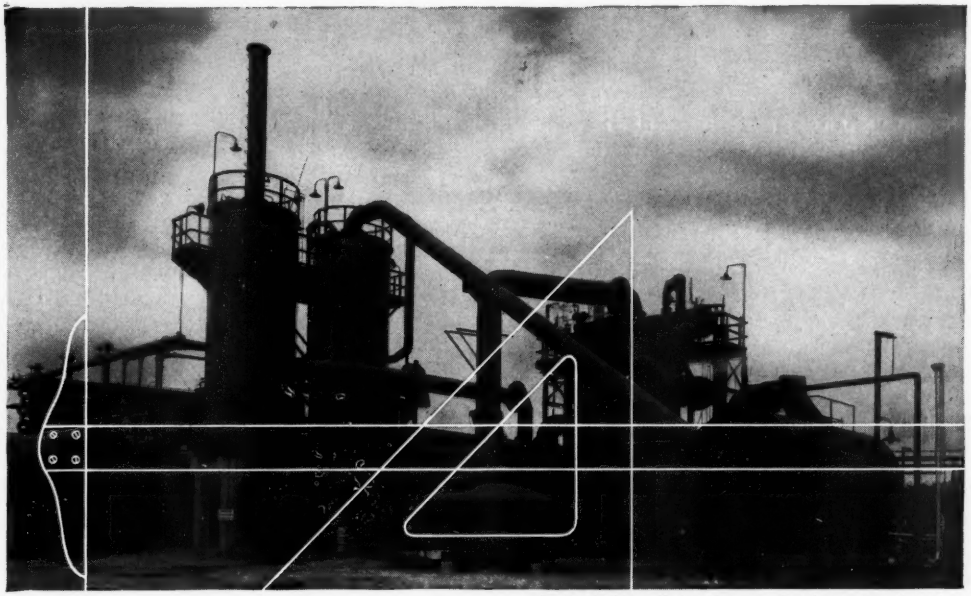
Ammonium Nitrate—Suppliers are in a well sold position and demand is strong. No changes in prices have been noted.

Nitrate of Soda—Demand continues seasonal and prices unchanged. Stocks are adequate.

OBITUARY

JOHN T. STEVENS

John T. Stevens, well-known member of the fertilizer industry, died at his home in Kershaw, S. C., January 19. Mr. Stevens was president of the Kershaw Oil Mill, the Catawba Fertilizer Co., and the Marion Cotton Oil Co., and at one time served as chairman of the South Carolina Highway Commission. On December 1, 1949, his 80th birthday, Kershaw put on a mass clelebration of "Stevens Day" in his honor.



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N.F.A. NAMES 1950 AS PASTURE YEAR

The interest of the American fertilizer industry is focused on the celebration of 1950 as pasture year and the year of the centennial of the first compounding of mixed fertilizers in the United States.

Under the leadership of the publicity program, outlined by the National Fertilizer Association's Dr. William Chace, association executives, presidents of national farm organizations, editors of farm journals, and the newspaper press are urging cooperation in calling the attention of farmers as well as the general public to the importance of more and better pasture.

Early impetus to the Pasture Year effort was given by the proclamation issued by Governor Elbert N. Carvel of Delaware proclaiming 1950 as Pasture Year.

Shortly after issuing this proclamation, Governor Carvel, a member of N.F.A.'s Board of Directors, sent a letter to all 47 of the other Governors urging them to issue similar proclamations. Along with the N.F.A. this magazine makes the suggestion that those identified with the National Fertilizer Association might like to write immediately to the Governors of their respective States in which such proclamations have not already been issued appealing to them to issue such proclamations.

Celebration of Pasture Year is already under way in several States. A spur to the celebration in the South was the winter grazing tour in Mississippi, February 7 and 8. This tour was sponsored by the Pasture Subcommittee of the N.F.A. Plant Food Research Committee in cooperation with Mississippi State College. Leading bankers and agricultural editors, as well as fertilizer representatives, agronomists, farmers, animal husbandmen, cattlemen, newspapermen, and radiomen were among those who participated.

Delaware Pasture Year Proclamation

WHEREAS, the health, welfare and prosperity of our State and nation is dependent upon the maintenance and continued development of a sound agricultural program; and

WHEREAS, the farmers of our nation are being called upon to make major adjustments in their postwar farming operations; and

WHEREAS, the development of good pastures is the most effective way to conserve and improve the soils of our State and nation and to utilize idle acres; and

WHEREAS, pastures are the most efficient and economical means of providing feed nutrients, vitamins and other elements necessary for the production of quality livestock and livestock products and at the same time provide profits to the farmers and high-quality, low-cost food to the consumer.

NOW, THEREFORE, I, ELBERT N. CARVEL, Governor of the State of Delaware, do hereby proclaim the year of 1950 as

PASTURE YEAR

in Delaware and urge all agricultural agencies, farm groups and other people and organizations interested in farming to participate in this program by holding meetings and discussion groups to encourage and promote the development of good pasture practices, to adopt the slogan, "Prosper with Pastures," and to do everything within their power to encourage our farmers to move forward in the year of 1950 with a sound pasture program.

ELBERT N. CARVEL
By the Governor:
HARRIS B. McDOWELL, JR.
Secretary of State

PLENTY OF PHOSPHATE PAYS, SAYS U.S.D.A.

A recent issue of *The Farm Cost Situation*, a U. S. Department of Agriculture publication, presents figures showing the increase in yields resulting from varying rates of application of phosphate fertilizer. Although the figures are based on an analysis of yield data obtained under Western irrigation conditions, studies in other areas have shown similar results.

The data show that if a farmer follows a definite rotation, fertilizer produces substantial yield increases, not only during the year in which it is applied, but also during the second, third, fourth, fifth and sixth years of rotation—even if no fertilizer is applied after the first year. Greater gains, in fact, were shown for the second and third years than for the first. The figures also show that, starting with 180 pounds of 20 per cent superphosphate per acre, the heavier the application the better the return. Five hundred forty and 720 pounds per acre are

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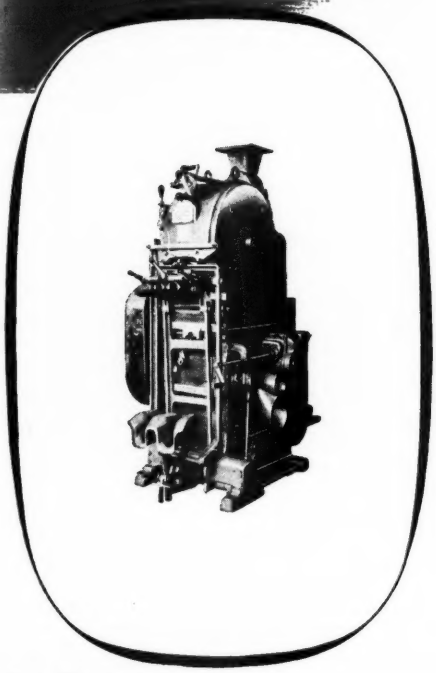

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Write today, or call the St. Regis Sales Office nearest you. Let our representative make a survey of your plant and make recommendations that may substantially increase your production and reduce your man-hour packing costs.

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easily seen in these examples: an application of 720 pounds per acre was followed by yields of 3.91 tons of alfalfa the first year, 6.86 tons of alfalfa the second year, 5.81 tons of alfalfa the third year, 279 cwt. of potatoes the fourth year, 252 cwt. of potatoes the fifth year and 76.7 bushels of wheat in the sixth year. Comparing these figures with the results of an application of 180 pounds the figures show that the heavier application produced an extra 8.77 tons of alfalfa, an extra 8,100 pounds of potatoes and an additional 19.5 bushels of wheat. The report also points out that, with favorable price relationships, it is probable that an application as high as 900 pounds per acre would be profitable.

STEEL STRIKE LOWERS 1949 SULPHATE OF AMMONIA

On account of the strike in the steel industry during October and part of November, production of sulphate of ammonia made from coke-oven ammonia during 1949 dropped 9 per cent from the figures for 1948. This loss was compensated in part by the 88 per cent increase in the production from purchased synthetic ammonia making the net loss about 5.3 per cent from the over-all 1948 production at the coke ovens. Ammonia liquor output also declined 8 per cent, according to the U. S. Bureau of Mines.

December production showed 71,272 tons of sulphate from by-product ammonia and 5,131 tons from purchased ammonia, which makes it the best month since May, 1949. Shipments of both kinds during December totaled only about 54,000 tons, which increased stocks on hand at producing plants on December 31st to 69,700 tons, which is almost 3 times the supply on hand at the end of 1948.

1949	Sulphate of Ammonia from By-Product Ammonia Tons	Sulphate of Ammonia from Purchased Ammonia Tons
January	73,826	4,491
February	67,810	4,146
March	74,256	4,862
April	72,465	4,743
May	73,194	4,433
June	67,118	3,983
July	63,501	3,834
August	66,521	5,584
September	63,684	5,269
October	20,087	5,443
November	44,925	5,912
December	71,272	5,131
Year, 1949	757,759	57,831
Year, 1948	830,683	30,749

LINK-BELT PROMOTES REGENSBURGER

Link-Belt Company announces that H. Walter Regensburger has been appointed Chief Engineer of the General Engineering Department to succeed Harry L. Strube, who has retired after many years' service in sales and executive engineering capacities; and that the department has been transferred from Philadelphia to 301 West Pershing Road, Chicago.

Assistaing Mr. Regensburger, will be Charles M. Young, Jr., in the capacity of Chief Developmental Engineer, and Harold F. Watson as Chief Standards Engineer. Both men have been identified with the General Engineering Department since it was first organized in Philadelphia in 1946, and both were previously members of the Philadelphia plant engineering department

U. S. D. A. SCIENTIST DISCUSSES SOUTHERN FERTILIZER PROBLEMS

Fertilizer is one of the answers to the big problem in the humid south according to Dr. R. Q. Parks, soil scientist of the U. S. Department of Agriculture.

Dr. Parks, speaking before the recent Southern Agricultural Workers meetings at Biloxi, Miss., listed several broad problems, which call for study. They are, as follows:

(1) What are the favorable levels of available soil phosphorus for different crops and soils? Southern farmers apply an average of 3½ times as much phosphorus in fertilizers as is removed in crops. Dr. Parks said that if favorable levels were known it might be more economical to apply the phosphorus all at one time rather than in small amounts over a period of 25 to 125 years.

(2) The extent to which deep-rooted legumes such as sericea and kudzu can be used to improve the soils.

(3) The rates at which native potash is released and how this release can be modified by management practices.

(4) Much more information is needed on the availability of minor elements in soils and the effect of modern management practices on their release.

(5) The possibility of using a wide range of liming rates together with greatly increased applications of the minor elements, potash, magnesium, and phosphorus to increase and maintain soil fertility.

PHOSPHATE AND NITROGEN DO BEST JOB ON MINN. OATS

In a recent magazine article, E. R. Duncan, University of Minnesota extension soils specialist, described results of a study comparing phosphate, potash and nitrogen-phosphate fertilizers on six soils areas in Minnesota.

Phosphate and nitrogen fertilizer produce best yields of oats on most Minnesota soils, according to Duncan's article, "Fertilizing Oats and New Seedings in Minnesota," which appeared in the December, 1949, issue of "What's New in Crops and Soils," a magazine published by the American Society of Agronomy.

For the state generally, 250 pounds to the acre of nitrogen-phosphate combination such as 10–20–0, gave the highest grain fields.

BEMIS CHECKS ON JUTE SITUATION

Once again Bemis Bro. Bag Company takes to the air to get a first-hand picture of the confused supply situation in jute and burlap in the far East.

W. D. McLean, assistant director of the burlap department, flew to Calcutta in January to investigate the trade slow down in Bemis supplies.

Practically all jute mills are located in the Calcutta area which is part of India, whereas most of the raw jute for these mills is produced in Pakistan. India, following Britain's example, devalued her rupee but Pakistan did not, which resulted in an unbalanced monetary relationship. This, together with ceiling prices fixed by the government of India on raw jute and burlap and by the Pakistan government on raw jute, has practically put a stop to trade between the two countries. Under these circumstances American importers have been almost without offers from their Calcutta shippers.

FERTILIZE STRAWBERRIES EARLY

The prediction was made recently by Extension Horticulturist Earl J. Allen, that Arkansas strawberry beds, if they get early applications of fertilizer, may yield an extra 25 to 50 crates per acre this year. Allen pointed out that the value of pre-growth fertilization from strawberries has been proven by the Experiment Station of the University of Arkansas College of Agriculture.

He recommended the practice even though strawberry beds received liberal amounts of fertilizer during the previous growing season.

Early fertilization does three big jobs, according to the horticulturist. It promotes (1) early plant growth, (2) full development of flowers, and (3) setting and development of berries.

Value of the pre-growth fertilization will be decreased if the application is delayed, Allen warned. If farmers wait until just before growth starts, the horticulturist explained, application of fertilizer will encourage production of heavy foliage at the expense of berry yields.

Recommended early application is at the rate of 15 to 25 pounds of nitrogen per acre, the amount found in 100 to 150 pounds of nitrate of soda. Or, the grower may prefer to use 200 to 300 pounds of 4–12–4 or 5–10–5 mixed fertilizer. If the berry field received no fertilizer durin the previous growing season, th amount of mixed goods may b increased to 500 pounds per acr or even more, Allen said, and eithe fertilizer should be broadcast ove the beds. Some burning of ol foliage that is green will result, bu this will not hurt the plants.

EARLY TOP-DRESSING FO OHIO PASTURES

In Ohio the farmers have learne the trick of top-dressing their pas tures with nitrogen fertilizer to hel them start grazing on their pasture 14 days earlier, according to D. B Dodd, agronomist at Ohio State.

In addition to getting a two-week jump on the pasture season, farmer using nitrogen found the total pro duction of forage averaged 70 pe cent greater on the treated area than where no nitrogen was applie

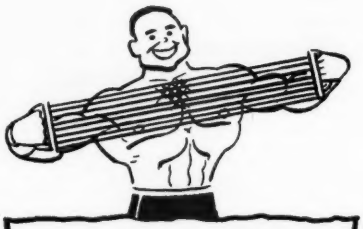
In these tests, supervised by th Agricultural Extension Service, th average application of nitrogen wa 60 pounds per acre. Most of th pastures were top-dressed befor April 1, although a few were treate the previous fall. Cost of the fer tilizer was about $9 per acre.

Dodd figures this cost was re turned many times in increased mil production and savings in barn feed

If the average pasture without nitrogen produces 1,000 pounds o milk per acre, he figures the nitro gen-treated areas with the 70 pe cent increase in forage produce 1,700 pounds. With milk at $3.5 per hundred, this meant an extra $24.50 worth of milk.

Treating of pastures with nitroge more than doubled the carryin capacity of the pastures. Dod says this represents a gain of approx imately 1,100 pounds of milk pe acre, or a return of $38.50 on thi $9 fertilizer investment.

Dodd recommends applying ni trogen before grass begins a vigorou growth in the spring.



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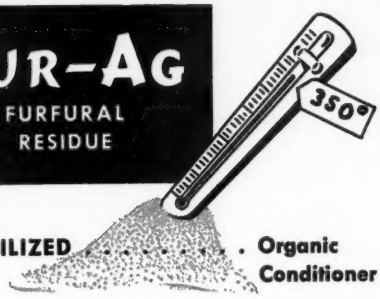

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Wisconsin Fertilizer School

Continued from page 11

alfalfa when adequately limed and fertilized.

"The first step in supplying and making available in the soil the needed plant nutrients is the application of sufficient amounts of lime as indicated by soils test. For best results, the lime should be applied a year or two in advance of seeding the alfalfa and thoroughly mixed into the whole plow layer. Beside supplying calcium and magnesium needed by the crop, the lime increases the availability of the phosphate naturally present in the soil and promotes the efficient use of that applied as fertilizer."

Little has been known about minor elements until recently, but K. C. Berger, of the Soils Department in Wisconsin, told the fertilizer industry "students" that more attention must be directed to minor elements in the future. He said, "During the past ten years, need for minor elements, particularly boron, has become widespread in Wisconsin. Vast acreages of alfalfa now show boron deficiency symptoms, corn yields in many places are reduced because of a lack of magnesium, copper or zinc. In addition, many truck crops have shown a need for boron and some for additional magnesium."

More Fertilizer Per Acre

Professor C. J. Chapman, one of the nation's leading extension agronomists gave the fertilizer dealers and salesmen some very sound information based on long experience and observation. He said, "Based on the demonstrations in 1949 and backed up by several years of previous work, farmers can profitably apply fertilizer at somewhat heavier rates per acre than are now being used on Wisconsin farms." Being more specific, he said, "Wisconsin soils need potash in increasing amounts for maximum yields of clover and alfalfa."

Chapman went on to say, "Here is another observation that I made this summer, and it concerns itself with nitrogen and the corn crop: Yes, the lack of nitrogen was the bottleneck that held down yields on thousands and thousands of acres of corn in Wisconsin this past year; in fact, this has been true for many years. And while we did carry out a considerable number of plow-sole fertilizer demonstrations which resulted in some outstanding yield increases again in 1949, yet I am more than ever convinced that nitrogen in the 800 to 1,000 pounds of 8–8–8 is the element most responsible for these large increases."

Chapman gave the fertilizer "students" a very definite recommendation for corn. "On low fertility fields and where no manure is available, apply from 600 to 800 lbs., of 8–8–8 or similar fertilizer per acre. These heavy rate applications of high-nitrogen fertilizer should be drilled in deep ahead of planting or placed o plow-sole with attachment on plow, or broadcast and plowed under."

The World Food Problem

Dr. Firman E. Bear, Chairman of the Soils Department at the New Jersey Agricultural Experiment Station, was a guest lecturer for the soil fertility school. He presented some "Food for Thought about Food." It seems that our ver increasing population is the cause of many problems because Dr. Bear said, "When man finally came into being he found himself in a Garden of Eden. There all his needs could be met merely by plucking the necessary food from the trees that grew in abundance everywhere about him. But Eve appeared on the scene, with the result that we now have some two billion people to support. Many millions of acres of land have been put to work in a vain effort to keep all these people in a reproductive state so that ever more of them could be born.

"In due time it came to pass that the food supply in some parts of the earth was insufficient to meet the needs of mankind. This finally led Thomas A. Malthus to a thoughtful consideration of the subject of population growth in relation to the food supply. Out of his deliberations came what has since come to be called the 'Malthusian principle,' which is to the effect that population tends to increase up to the limit set by the food supply. The only certain relief from this situation was said to be in famine, pestilence, and war."

Dr. Bear proceeded to outline the many ways of increasing food production and concluded by saying, "Research holds hope of unlocking the secret of the chlorophyll molecule of green plants and putting the principle to work to transform water and air into carbohydrates on a factory basis.

"The final answer lies in harnessing the winds, tides, and running waters, in putting the wasted sunshine of the Great American Desert to work, in further development of our knowledge of the atom, all of which have possibilities of greatly increasing our energy resources.

"Given adequate energy, wet land can be drained, gullied land can be leveled, that in the shallower parts of the sea can be reclaimed from the sea, and the ocean water can be distilled for use on the Great American Desert.

Soil Conservation

"All we need to do is to make intelligent use of the abundant resources at our command."

Dr. R. J. Muckenhirn, Department of Soils, University of Wisconsin, speaking on the subject of soil

conservation, emphasized that soil conservation involves much more than mechanical structures. He said, "Most erosion control programs require liming, fertilizing, shifts in rotations, changes in acreages, relocation of fences, increases in live stock numbers of other measures which involve an initial cost to the farmer. Certainly among the easiest of these to justify is the use of lime and fertilizer as needed because it will ordinarily return a yrofit in the first year or two. The other practices often do so also but some of them, such as the seeding of forage crops or expansion in livestock numbers, may not 'pay out' fully until the second, third, or fourth year. The production of larger crops through the use of fertilizer may make possible the accumulation of surplus with which to defray the costs of beginning a program of soil conservation. Further, when this beginning involves lime and fertilizer purchases, these purchases are usually offset by equal or larger financial returns in a relatively short time. Liming and fertilizing for the benefit of a forage crop may actually increase the yield of the grain companion crop sufficiently to meet the cost of the application."

Muckenhirn concluded with this statement. "Experiments in recent years have also shown that land severely damaged but not destroyed by erosion can be restored to satisfactory levels of production by the use of lime and fertilizer. The costs involved may equal or exceed the value of the land before improvement but the restoration is often profitable nevertheless. Undoubtedly, very considerable possibilities for soil restoration or renewal do exist and better knowledge of soil management and the use of new or cheaper fertilizer materials should enable us to develop these possibilities in certain eroded areas."

Dr. M. L. Jackson concluded the school with a very optimistic statement for the fertilizer industry. He said, "The use of nitrogen fertilizer is increasing by leaps and bounds in the United States but, even so, our use is really negligible compared to the intensive use of nitrogen in the highly developed agricultural economies of countries like Norway, Netherlands, and Western Germany. The rates of nitrogen applied per cultivated acre ranges from 60 to 100 lb. in these countries. We note that New Jersey has a comparable rate. In U. S., and in Wisconsin, it is less than 10 lb. per cultivated acre. With the population of the U. S., increasing at the rate of 2 million persons per year for the past decade, and 2.3 million last year, combined with the probability that average weather will replace the favorable weather of the past seasons, the corn surpluses can be expected to disappear. We may expect the rate per acre of elemental nitrogen applied to increase in the U. S. and to increase in Wisconsin. One of the increases will be as a side-dressing to corn."

AGRONOMISTS ADVISE FARMERS FACING POTASH SHORTAGE

Many southern agronomists are sounding the warning that farmers in their states are facing a real potash shortage.

Recent developments in the potash industry have not solved the problem and the national potash shortage makes it impossible for manufacturers to put as much of it into fertilizer as usual. This is the reason farmers who have improved pastures that need fertilizing or are building new pastures will probably experience a potash shortage if they wait until later to resume their pasture work.

To keep pasture work moving, the agronomists suggest that superphosphate or basic slag be used now. Later on when potash becomes available, apply it as a top-dressing.

Japanese Fertilizer Experiment and Crop Yields

(*Continued from page 10*)

per cent in Japan? Such an increased production would mean a 50 per cent larger corn crop, wheat crop, etc., without increasing the acreage. Actually, the total acreage of cropland has not changed much since 1920 (*3*).

To obtain these increases, it is evident that more attention would have to be given to such things as increased use of fertilizers tailor-made for given soil types and crops[11]; use of better plants, especially hybrids; better control of insects and plant diseases; accelerated use of supplemental irrigation; development of all-around weed control through chemicals and by cultivation; use of better farm machinery; employment of sound land use and soil conservation measures; and top-notch farm management methods by individual farmers.

Because overproduction would result if yields increased greatly, the poorer land could be retired to grass and tree crops and more of the land in row crops rotated with grasses and legumes. Soil erosion would be better controlled and fertility of the land increased. Using again the development of hybrid corn as an example of the effect of increased production on land use, it has been estimated that 12 million additional acres of open-pollinated varieties would have been needed to produce as much corn as

[11] This practice is now in effect in the shade tobacco growing section of the Connecticut Valley. Rapid soil tests are made by the Tobacco Laboratory of the Connecticut Agricultural Experiment Station at Windsor and the farmers add only the fertilizers needed as revealed by the tests. Most of the fertilizers are home-mixed according to the tests. Thus crop requirements for maximum yield and quality are met and wasteful addition of fertilizers not required is eliminated. Production of shade grown tobacco is highly specialized farming and attention given this crop cannot likewise be economically applied to most crops yet.

the 60 million acres planted to hybrid corn in 1949.

If the same rate of increase (*3*) in food production (three per cent annually) that took place from 1935–1939 to 1946 continued, only about 17 years would be needed to effect a 50 per cent larger crop yield. Although it may appear optimistic, if advanced agricultural technology as mentioned above were introduced on an extensive scale in the United States, perhaps this time interval might be reduced still further.

For various reasons, comparisons between the two countries are not strictly comparable but in view of the relatively advanced state of technological development in the United States compared with that in Japan, the increased yields in Japan are still more remarkable.

It appears, then, that a country does not need all of the newest gadgets and devices for increasing production, although there is no question that they are helpful and more efficient. More important, it seems, is the will to produce and the labor, energy, basic materials and modern knowledge of crop production *for the area in question* to carry out that will. All too often modern techniques have been applied with disappointing results to areas still in the hand-sickle era. An example would be applying the large-scale rice-production methods employed in the United States to the one- or two-acre rice paddies of Japan. Introduction of modern techniques as fast as they can be intelligently absorbed and adjusted to areas now producing poorly should increase their food production greatly.

Summary

This paper describes field experiments with fertilizers on the major agricultural crops grown in Japan. Lowland rice has received by far the most attention. This paper reports experiments on lowland rice, upland rice, wheat, covered barley, naked barley, sweet potato, white potato, Satsuma orange, tea, and mulberry.

Methods used in Japan when carrying out fertilizer field experiments are generally not as refined as methods currently used in the United States and in some European countries. Field experiments are usually conducted on very small plots frequently less than a square meter (1.2 square yards) in area. Replication of treatment is often omitted and plots are established without any statistical design.

According to data obtained, nitrogen is by far the most important fertilizer nutrient influencing grain yield of both lowland and upland rice. Phosphorus and potassium also increase yields of these crops, especially upland rice. Optimum applications of these nutrients for lowland rice appear to range from 60 to 120 kg. (53.5 to 107.1 lb./acre) of N, 20 to 60 kg. (17.8 to 53.5 lb./acre) of P_2O_5, and 40 to 80 kg. (35.7 to 71.4 lb./acre) of K_2O per hectare.

Nitrogen also exerts the greatest influence on the yields of wheat, covered barley, and naked barley. Less effect is noted from phosphorus and potassium. Optimum applications for these crops appear to range from 80 to 120 kg. (71.4 to 107.0 lb./acre) of N, 40 to 80 kg. (35.7 to 71.4 lb./acre) of P_2O_5, and 20 to 60 kg. (17.8 to 53.5 lb./acre) of K_2O per hectare.

Results of field experiments indicate that potash is the most important fertilizer nutrient required for maximum production of sweet potatoes. For white potatoes, liberal applications of nitrogen, phosphoric acid, and potash are essential for high yields.

In a field experiment conducted in Shizuoka Prefecture, organic nitrogenous fertilizersappear to be superior to inorganic nitrogenous fertilizers in increasing the yield of tealeaves. For mulberry, however, inorganic sources of nitrogen were superior to organic sources. Nitrogen seemed to be the most important fertilizer nutrient required by mulberry trees to maintain high yields of leaves.

In spite of the fact that Japan's experimental techniques may be somewhat antiquated, using as a basis of comparison the five-year periods ending 1882 and 1942, production of rice increased 70 per cent; wheat, 140 per cent; common barley, 119 per cent; naked barley, 62 per cent; and tea, 180 per cent. For a like period in the United States, production for similar crops increased as follows: wheat, 23.4 per cent; barley, 4.4 per cent; oats, 16.8 per cent; and corn, 19.3 per cent. Production in the United States increased substantially the next five years but still did not approach those in Japan.

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ALFALFA NEEDS PLENTY OF POTASH

In Kentucky the number of alfalfa growers is increasing according to Dr. W. A. Seay of the College of Agriculture. With this increased interest in alfalfa comes the need for heavier applications of potash to give long life to "The Queen of Forage Crops."

Alfalfa uses up large amounts of potash, Seay said, and several cuttings a season may so reduce the potash in the soil that the alfalfa no longer produces well, or may even fail to survive.

Farmers are accustomed to applying phosphate fertilizer when seeding alfalfa, Prof. Seay noted, but they often fail to use any potash.

The relation between the amounts of potash in the soil and in the alfalfa itself was pointed out. Good alfalfa hay contains about 2 per cent potassium. To have this, the land should contain 150 to 200 pounds of available potassium an acre.

Top-dressing land with about 200 pounds of 60 per cent muriate of potash an acre after the last cutting of the year was recommended by Dr. Seay for alfalfa two years or older. Increase in yield the following year will more than pay the cost, he said. Potash not only keeps the alfalfa living longer, he said, but also increases the yield and improves the quality of the hay.

Pasture Fertilization

(*Continued from page 8*)

have healthy and abundant winter grazing by mid-October.

Insufficient minor or secondary elements in the soil and grazing crops have been found to greatly reduce or limit livestock production in extensive areas of some sections of the Southeast. Boron, sulphur, magnesium, copper, cobalt and others have been shown by experiments to be needed by grazing crops or livestock in one area or another. More extensive investigations are needed to determine other areas where relatively small amounts of these materials are needed for the best results in pasture and livestock production.

Winter Grazing Possible Through Fertilization

One of the greatest developments in the Southeast in the field of pasture and livestock production in recent years has been in providing winter pastures, and here as with the summer pastures, proper fertilization has played a vital role. Using mostly the same plants that had previously provided some spring grazing, proper fertilization and earlier seeding practices greatly increased early fall and winter forage production. In winter forage clipping experiments, for example, only eleven per cent of the total oat forage was produced during the

winter months prior to March 1 without fertilization, while 38 per cent of the total forage was produced in this fall and winter period when adequate fertilization was practiced.

Such annually seeded winter pastures consisted variously of any winter grain (oats, barley, wheat, rye) alone or in mixture; frequently, especially for dairy cattle grazing, rye grass and crimson clover or vetch were included in the seeding mixture to extend the spring grazing period. The rye grass also produced a better sod, allowing grazing during unfavorable high soil moisture conditions. Fertilizer practices vary—300 to 800 pounds of a 6–8–6 or similar fertilizer is applied per acre at seeding time, and from 24 to 48 pounds of nitrogen is top-dressed in fall and again in late winter. The heavier fertilizer practices are usually followed by dairymen while the lighter ones are used more by beef cattlemen.

High livestock production has been obtained from winter grazing, provided fertilization is not neglected. In Georgia, a three year average net profit of $97.23 per acre was obtained with dairy cattle from fertilized winter pastures while a net profit of only $38.20 per acre was obtained from unfertilized winter pasture. These net profits are in terms of value of milk produced per acre above all barn feed and pasture costs. Annual fertilizer and nitrogen top-dressing costs were only $14.21 per acre and gave a $59.03 greater net profit per acre than where no fertilizer was used. Mississippi also obtained high net returns, $77.82 per acre, from winter pastures with dairy cattle. When adequate amounts of winter grazing was available, net profits obtained per dairy cow increased as the amount of concentrates fed was decreased.

In addition to providing nutritious and low-cost feed to dairy cattle, winter grazing enhances the vitamin A value of milk produced. Milk from cows on winter pasture contained 232 per cent more carotene and 81 per cent more vitamin A activity than milk from cows on barn feed only. This higher nutritive value of milk for human consumption and its greater sales appeal (due to color) should be an added incentive for dairymen to have winter pastures, and could become a factor in competitive dairy production in winter months.

Winter pasture utilized by beef cattle have also shown excellent financial returns. Yearling steers on winter grazing gave net returns of $39.00 to $78.00 per acre in Mississippi. In one Georgia experiment, yearling beeves gained 2.76 pounds daily on oats-rye grass crimson clover and produced 303 pounds gains per acre. The finish and grade of such beeves on good oat pasture in spring is such that they bring a price nearly equal to that of finished cattle.

Types of Winter Grazing

Intensively fertilized, annually seeded winter pastures as discussed so far entail costs of $25.00 to $35.00 per acre annually. This cost can usually be defrayed readily and leave considerable net profit when young growing animals or milk producing animals utilize the pastures. However, the greatest demand and need for winter grazing has been for the maintenance of beef brood cows during winter for calving in spring. For such utilization, lower cost winter pastures are desirable. Also, labor and machine requirements for other farm enterprises frequently necessitate the establishment and use of winter pastures that better fit into the farm program. It is partly for this reason that Dixie crimson clover and other winter annual volunteering legumes and grasses are becoming so popular. The widely adapted perennial fescue grass is being seeded extensively for the same reason. Winter wheat and other fall sown grains seeded primarily for grain production can furnish a moderate amount of winter grazing at relatively low net cost. Considerable acreages of velvet beans are still grown in certain areas in summer to be grazed in fall and in winter. Other surplus forage grown in summer and fall is similarly utilized for winter grazing. Any one farm frequently has at least two or three of these types of winter pastures and this is desirable from the standpoint of insuring more continuous and lower cost winter grazing.

Crimson clover usually is slower to start growth in fall and furnishes grazing in late winter and spring, necessitating some other grazing crop for early winter unless extensive acreage is available. However, late summer disking and fertilization stimulate earlier growth so that more fall and early winter grazing will be available. Fertilization of fescue grass in early fall is also desirable so that fall growth is obtained. It is highly desirable to have a clover (usually Ladino or white, sometimes crimson or subterranean clover) in mixture with fescue to enhance the palatability, nutritive value and production of the forage. Because of the aggressive and competitive character of fescue grass, proper fertilization and grazing management of this grass-clover combination will be highly important in keeping a desirable grass-legume mixture. This will call for judicious mineral as well as nitrogen fertilization. Fescue is being seeded extensively in areas where it is not too well adapted, and under such conditions adequate fertilization and proper grazing management are critical for the establishment and maintenance of this grass.

Various summer and winter pastures can be grown in the South; some of these are widely adapted while others are adapted to more limited soils and areas. But these provide many southern farmers with a number of alternative pastures that can best be fitted into his particular facilities and needs. Twelve months' grazing can be provided for dairy cattle in much of the Southeast. The beef cattle enterprise can be adjusted to take advantage of any particular grazing program best suited to the conditions. This augers well for a continued expansion of livestock in the Southeast. Pasture fertilization has been a vital factor in making possible productive long season pastures. Much is still to be learned, however, regarding adequate fertilization of pastures. As more knowledge on this all-important problem becomes available and is put into farm practice, we should have still more productive pastures and livestock enterprises and at lower costs per unit of production.

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American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Barrett Div., Allied Chemical & Dye Corp., New YorkCity
Commercial Solvents Corp., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
Scar-Lipman & Co., New York City
Spencer Chemical Co., Kansas City, Mo.
Virginia-Carolina Chemical Corp., Richmond,Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.
Woodward Iron Company, Woodward, Ala.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Wiley & Company, Baltimore, Md.

CONDITIONERS
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
National Lime & Stone Co., Findlay, Ohio
Quaker Oats Company, Chicago, Ill.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Scar-Lipman & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

FERTILIZER (Mixed) MANUFACTURERS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago
Southern States Phosphate & Fertilizer Co., Savannah, Ga
Virginia-Carolina Chemical Corp., Richmond, Va.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Scar-Lipman & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

HOPPERS
- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore ,Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

IMPORTERS, EXPORTERS
- Armour Fertilizer Works, Atlanta, Ga.
- Ashcraft-Wilkinson Co., Atlanta, Ga.
- Baker & Bro., H. J., New York City
- Scar-Lipman & Co., New York City
- Southern States Phosphate & Fertilizer Co., Savannah, Ga.
- Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
- American Agricultural Chemical Co., New York City

LEAD BURNERS
- Southern Lead Burning Co., Atlanta, Ga.

LIMESTONE
- American Agricultural Chemical Co., New York City
- Ashcraft-Wilkinson Co., Atlanta, Ga.
- McIver & Son, Alex. M., Charleston, S. C.
- National Lime & Stone Co., Findlay, Ohio

LOADERS—Car and Wagon
- Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
- Atlanta Utility Works, The East Point, Ga.
- Chemical Construction Corp., New York City
- Monarch Mfg. Works, Inc., Philadelphia, Pa.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Ammoniating
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Sturtevant Mill Company, Boston, Mass.

MACHINERY—Grinding and Pulverizing
- Atlanta Utility Works, The, East Point, Ga.
- Bradley Pulverizer Co., Allentown, Pa.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

MACHINERY—Material Handling
- Atlanta Utility Works, The, East Point, Ga.
- Baughman Manufacturing Co., Jerseyville, Ill
- Hayward Company, The, New York City
- Hough Co., The Frank G., Libertyville, Ill.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

MACHINERY—Mixing, Screening and Bagging
- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.
- Universal Vibrating Screen Co., Racine, Wis.

MACHINERY—Power Transmission
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

MANGANESE SULPHATE
- McIver & Son, Alex. M., Charleston, S. C.

MINOR ELEMENTS
- Tennessee Corporation, Atlanta, Ga.

MIXERS
- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

NITRATE OF SODA
- American Agricultural Chemical Co., New York City
- Armour Fertilizer Works, Atlanta, Ga.
- Ashcraft-Wilkinson Co., Atlanta, Ga.
- Baker & Bro., H. J., New York City
- Barrett Div., Allied Chemical & Dye Corp., New York City
- Huber & Company, New York City
- International Minerals & Chemical Corporation, Chicago, Ill.
- McIver & Son, Alex. M., Charleston, S. C.
- Scar-Lipman & Co., New York City

NITROGEN SOLUTIONS
- Barrett Div., Allied Chemical & Dye Corp., New York City
- Lion Oil Company, El Dorado, Ark.
- Phillips Chemical Co., Bartlesville, Okla.
- Spencer Chemical Co., Kansas City, Mo.

NITROGENOUS ORGANIC MATERIAL
- American Agriculture Chemical Co., New York City
- Armour Fertilizer Works, Atlanta, Ga.
- Ashcraft-Wilkinson Co., Atlanta, Ga.
- Baker & Bro., H. J., New York City
- Davidson Commission Co , The, Chicago, Ill.
- Huber & Company, New York City
- International Minerals & Chemical Corporation, Chicago, Ill.
- Jackle, Frank R., New York City
- McIver & Son, Alex. M., Charleston, S. C.
- Scar-Lipman & Co., New York City
- Tuteur & Co., New York City
- Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
- Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
- American Agricultural Chemical Co., New York City
- Armour Fertilizer Works, Atlanta, Ga.
- Ashcraft-Winkinson Co., Atlanta, Ga.
- Baker & Bro., H. J., New York City
- Huber & Company, New York City
- International Minerals & Chemical Corporation, Chicago, Ill.
- McIver & Son, Alex. M., Charleston, S. C.
- Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
- Atlanta Utility Works, The, East Point, Ga.
- Chemical Construction Corp., New York City
- Monsanto Chemical Co., St. Louis, Mo.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Southern Lead Burning Co., Atlanta, Ga.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.
- Titlestad Corporation, Nicolay, New York City

POTASH SALTS—Dealers and Brokers
- American Agricultural Chemical Co., New York City
- Armour Fertilizer Works, Atlanta, Ga.
- Ashcraft-Wilkinson Co., Atlanta, Ga.
- Baker & Bro., H. J., New York City
- Huber & Company, New York City
- International Minerals & Chemical Corporation, Chicago, Ill
- Jackle, Frank R., New York City
- McIver & Son, Alex M., Charleston, S. C.
- Scar-Lipman & Co., New York City

POTASH SALTS—Manufacturers
- American Potash and Chemical Corp., New York City
- Potash Co. of America, New York City
- International Minerals & Chemical Corporation, Chicago, I
- United States Potash Co., New York City

PRINTING PRESSES—Bag
- Schmutz Mfg. Co., Louisville, Ky.

REPAIR PARTS AND CASTINGS
- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.

BUYERS' GUIDE

SCALES—Including Automatic Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Mach. Works, Aur ora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Universal Vibrating Screen Co., Racine, Wis.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Barrett Div., Allied Chemical & Dye Corp., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
Lion Oil Co., El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
Scar-Lipman & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.
Woodward Iron Company, Woodward, Ala.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Texas Gulf Sulphur Co. New York City

SULPHURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

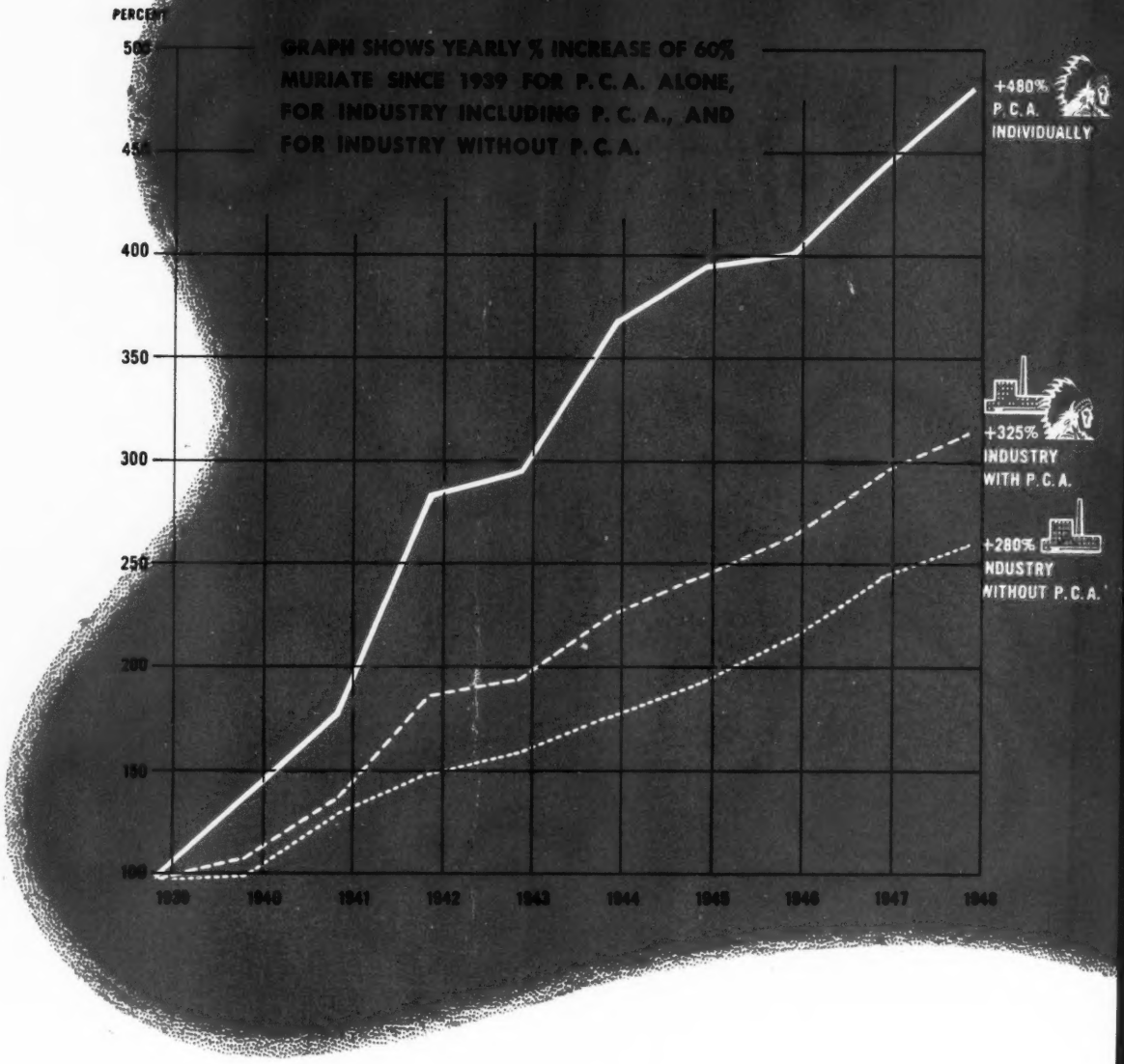
SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

VALVES
Atlanta Utility Works, The, East Point, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

Alphabetical List of Advertisers

been doing some figuring...



1948 was a record year for domestic Potash. Using '39 as a base, the industry—not including P.C.A.—showed an increase of 280% in 60% Muriate. P.C.A. production lifts the industry increase to 325%. ***P.C.A. alone shows a High Grade Muriate increase for the same period of 480%.***

95% of all P.C.A.'s '48 deliveries were in the form of 60% Muriate. Our new $4,000,000 production and refining facilities now are operating. Our deliveries for '49-'50 will break all previous records. In fact, P.C.A.'s production capacity for 60% Muriate this year will exceed by some 150,000 tons the entire potash consumption — all grades — of the nation ten years ago.

These figures are graphic evidence of the leadership P.C.A. has won . . . leadership in volume, in economy to you and to agriculture.

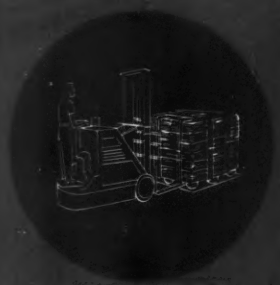
P.C.A.
SALT of the EARTH
RED MURIATE

Potash Company of America
Carlsbad, New Mexico

GENERAL SALES OFFICE . . 50 Broadway, New York, N. Y. • MIDWESTERN SALES OFFICE . . First National Bank Bldg., Peoria, Ill
SOUTHERN SALES OFFICE . . Candler Building, Atlanta, Ga.

from design to delivery-

BETTER MULTIWALL BAGS



LOWER HANDLING COSTS

BAGPAK
DIVISION

INTERNATIONAL PAPER COMPANY, Bagpak Division
220 EAST 42nd ST., NEW YORK 17, N. Y.

BRANCH OFFICES: Atlanta, Baltimore, Boston, Chicago, Cleveland, Baxter Springs, Kansas, Los Angeles, New Orleans, Philadelphia, Pittsburgh, St. Louis, San Francisco.

In Canada: Continental Paper Products, Ltd., Montreal, Ottawa

From the original designing of the many varieties of Bagpak Multiwall Bags, through manufacturing *to final delivery*, Bagpak engineers are alert to new and better ways to minimize *your* costs—increase *your* packaging efficiency.

Palletized shipments of Bagpak bags lower handling costs for you—a typical example of how Bagpak engineers work as your "partners in packaging".

Let Bagpak—manufacturers of multiwall bags and bag packing machinery—put its broad experience at your disposal.